

REMARKS

In view of the above amendments and the following remarks, Applicant requests favorable reconsideration and allowance of the above-identified application.

Claims 1-7 and 9-22 are now pending in this application, with Claims 1-7, 9-12 and 20-22 being independent. By this Amendment, Applicant has amended the specification and added newly presented Claims 20-22. No new matter has been added.

The drawings stand objected to under 37 CFR § 1.84(p)(4). Attached to this Amendment is a Request for Approval to Amend the Drawings in which Applicant has proposed amending Figure 12 to attend the matter set forth in the Office Action as giving rise to the objection.

Claims 18 and 19 stand rejected under 35 U.S.C. § 112, as being indefinite. Applicant has added Claims 20-22 to attend to the matters set forth in the Office Action as giving rise to the rejection. Accordingly, Applicant requests withdrawal of the rejection under § 112, second paragraph.

Claims 1, 11, 12 and 13-17 stand rejected under 35 U.S.C. § 103, as unpatentable over U.S. Patent No. 6,157,488 (Ishii). Claims 2-7, 9, 10 and 13-19 stand rejected under 35 U.S.C. § 103, as unpatentable over the Ishii patent in view of U.S. Patent No. 5,279,924 (Sakai, et al.). Applicant traverses these rejections.

As recited in independent Claims 1, 2, 4, 5, 9, 11, 12 and 20-22, Applicant's invention is directed to a diffractive optical element including diffractive gratings differing in dispersion from each other and having a space layer of a diffractive index of 1.

As recited in independent Claims 3, 6, 7 and 10, Applicant's invention is directed to a diffractive optical element including a pair of diffractive gratings differing in

dispersion from each other. In addition, the maximum optical path length difference occurring in the pair of diffractive gratings with respect to each of at least two wavelengths is m (integer) times the wavelength and the values of m in the two wavelengths are the same with peak and valley portions of the pair of diffractive gratings being formed in a chamfered shape.

The Ishii patent is directed to a diffractive optical element having a stack of first, second and third optical regions. While acknowledging that the patent does not describe that the second optical region has a diffractive index of 1, the Office Action states that such an index could be arrived at by the teachings in that document. Applicant respectfully disagrees.

The Ishii patent discloses that in order to reduce wavelength dependency of diffraction efficiency, $\Delta N(\lambda)$ is increased with the increase of the wavelength, as represented by formula 15 in that patent. To achieve this, there is suggested utilizing a phase difference generated by a diffractive grating composed of a combination of polycarbonate and acrylic resin and a combination of polycarbonate and UV curable resin. In other words, there is a combination of a polycarbonate and a material of low refractive index and low dispersion. The refractive index difference of the gratings of these materials slopes upwards (i.e., increases) with the increase of the wavelength, as shown in Figure 9 of that

patent. Therefore, the diffractive grating described in the Ishii patent involves a combination of polycarbonate and a material of low refractive index and low dispersion, in order to reduce wavelength dependency of diffraction efficiency.

In contrast, the present invention is directed to a diffractive optical element in which, assuming at least two design wavelengths, $\Delta N(\lambda)$ can be increased by the increase

of the wavelength and the desired performance can be obtained even if a pair of diffractive gratings face a space of a refractive index of 1. There is no suggestion in the Ishii document to provide a second optical region having such a refractive index.

This deficiency is not remedied by the Sakai, et al. patent.

Accordingly, Applicant submits that the Ishii and Sakai, et al. patents, taken alone or in combination, fail to disclose or suggest at least the features of diffractive grating layers differing in dispersion from each other and having a space layer of refractive index of 1, as recited in independent Claims 1, 2, 4, 5, 9, 11, 12 and 20-22.

With respect to independent Claims 3, 6, 7 and 10, Applicant notes that the Sakai, et al. patent is directed to a method of manufacturing an optical diffraction grating element using an ion beam. The specification thereof states that an optical element made by the method “possesses a high diffraction deficiency” (column 6, lines 35 and 36). Applicant submits that such a diffraction deficiency is due to the fact that the diffracting grating is formed to have a blazed configuration. Applicant does not understand the Sakai, et al. patent to describe the effect of curved surface 20 on diffraction deficiency. In other words, that document fails to describe improving diffraction efficiency by forming peak or valley portions of a diffractive grating into a chamfered shape.

Accordingly, Applicant submits that the Ishii and Sakai, et al. patents, taken alone or in combination, fail to disclose or suggest at least the features of a pair diffractive gratings differing in dispersion from each other and confronting each other, wherein a maximum optical path length difference occurring in light passing through the pair of diffractive gratings with respect to at least two wavelengths is m (integer) times the wavelength, and the values of m in the two wavelengths are the same, with peak portions


and valley portions of the pair of diffractive gratings being formed in a chamfered shape, as recited in independent Claims 3, 6, 7 and 10.

Therefore, Applicant submits that the independent claims are allowable over the applied documents, and requests withdrawal of the rejections under 35 U.S.C. § 103.

The remaining claims in the present application are dependent claims which depend from the independent claims discussed above, and thus are patentable over the applied documents for the reasons noted above with respect to those independent claims. Further, each recites features of the invention still further distinguishing it from the applied documents. Therefore, Applicant requests favorable and independent consideration thereof.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE TO SPECIFICATION

Also, in the first embodiment, the chamfered form has been in the flat plane. However, the chamfered form is not limited to the flat plane. For example, the chamfered form may otherwise be such a curved surface that, when projected to a plane (X-Y plane) defined by the X direction of grating arrangement of the grating surface and a Y direction in the normal to the substrate, it becomes a curved line as shown in Fig. 12. That is, a round form in the X-Y plane may be used with a minute radius of curvature $[R]_r$. In this case, too, it is preferred that the same as the above-described chamfered amount for the flat plane [applies] apply to the radius $[R]_r$ of the curved surface, lying in the following range:

$$[0.5 \mu\text{m} < R < 2 \mu\text{m}] \quad \underline{0.5 \mu\text{m} < r < 2 \mu\text{m}}$$